

The Effects of State-Mandated Abstinence-Based Sex Education on Teen Health Outcomes

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Abstract

In 2011, the United States had the second highest teen birth rate of any developed nation, according to the World Bank. In an effort to lower teen pregnancy rates, several states have enacted policies requiring abstinence-based sex education. In this study, we utilize a difference-in-differences research design to analyze the causal effects of state-level sex education policies from 2000–2011 on various teen sexual health outcomes. We find that state-level abstinence education mandates have no effect on teen birth rates or abortion rates, although we find that state-level policies may affect teen sexually transmitted disease rates in some states.

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1 Introduction

Despite the resources spent on lowering teen birth rates, nearly 330,000 U.S. teenagers became mothers in 2011, placing the U.S. near the top of developed countries worldwide. Teen childbearing can be costly to individuals and society, and many state governments invest in preventative measures to curb future costs.^{1,2} One such investment, sex education, has become more prevalent in an effort to combat the high rates of teen pregnancy and sexually transmitted diseases (STDs). However, there has been a substantial debate over the content of sex education classes.

In the past two decades, sex education has moved away from more comprehensive programs in favor of abstinence-based curricula that stress the importance of monogamous sexual relationships with a spouse (Lindberg et. al, 2006; Perrin and DeJoy, 2003). Comprehensive programs, in contrast, cover a more broad range of prevention tactics and include education about contraception. The potential consequences of abstinence education are unclear. Advocates of abstinence education argue that these programs discourage teenage sexual frequency and onset by increasing the perceived cost of having sex, leading to a lower incidence of teen pregnancy and STDs. Critics of abstinence-based sex education argue that teens' decisions to engage in sexual intercourse are independent of school curriculum, and the lack of information about contraception encourages risky sexual behavior, which could lead to higher rates of pregnancy and STDs.

While there is a large literature examining the effectiveness of sex education in general, there is less evidence on the effects of content requirements. Most studies focus on school or district-level interventions and analyze survey data about teen sexual behavior. Many of

¹According to the National Campaign to Prevent Teen and Unplanned Pregnancy, the national cost of teen childbearing, including costs for welfare, public sector health care costs, and lost tax revenues, topped \$10.9 billion in 2008.

²There is some evidence that teenage mothers tend to be worse off in terms of educational attainment, lifetime wages and health (Geronimus and Korenman, 1992; Bronars and Grogger, 1994; Hoffman et al., 1993; Holmlund, 2005; Lee, 2010). Furthermore, delaying childbearing can have positive effects on a woman's firstborn child's educational achievement (Miller, 2009), and increases in teen parenting cause later increases in crime rates (Hunt, 2006).

these studies find that neither abstinence-based programs nor comprehensive programs are significantly correlated with teen intercourse, although comprehensive programs are associated with decreased risky sexual behavior (Kohler et al., 2008; Lindberg and Maddow-Zimet, 2012; Sabia, 2006; Trenholm et al., 2008).³

Even though most sex education content requirements are mandated on the state-level, few studies have analyzed the relationship between state-level policies and teen health outcomes. Because the states with such mandates are inherently different from those without them, causal inference is challenging in this setting. Previous studies have shown that state-level abstinence mandates are correlated with higher STD rates (Hogben et al., 2010) and higher teen birth rates (Stanger-Hall and Hall, 2011). However, no studies to our knowledge have estimated a causal link between state-mandated sex education curriculum and teen health outcomes.

Although the effect of abstinence mandates has remained unstudied, recently a number of studies have looked at the effects of similar state-level policies. Kearney and Levine (2012) control for state-level sex education content requirements and sex education funding within a model aimed at determining demographic trends in childbearing and find no effects on teen birth rates. Cannonier (2012) uses a difference-in-differences methodology and finds that Title V abstinence-based funding only significantly decreases birth rates for white 15–17-year-olds and does not effect other race or age groups. While Title V funding aims to create incentives for states to emphasize abstinence in sex education, changes to funding may be less likely to affect teen health outcomes than required curriculum changes.

This paper fills a void in the literature by examining the causal effect of state-mandated abstinence education on teen pregnancy and STD rates. To do so, we use a difference-in-differences research design to determine whether states that adopt abstinence-based sex education mandates experience changes in teen birth rates, STD rates, or abortion rates

³For an extensive review of randomized controlled experiments on this topic, see Bennett and Assefi (2005). They report that some programs that emphasized abstinence but also taught contraception decreased sexual frequency, although several studies found no effects on teen sexual behavior.

relative to other states over the same time period. The identifying assumption is that absent the sex education mandate, adopting and non-adopting states would have experienced similar changes in teen health outcomes.

Several exercises lend support to this identifying assumption. First, we provide graphical and statistical evidence that the trends for the two groups were not diverging prior to the enactment of the sex education policy. Moreover, we show that the inclusion of important time-varying covariates does not affect our estimates. This suggests that the within-state variation we are exploiting for identification is orthogonal to observable determinants of health outcomes, which gives us some comfort that our estimates might also be unaffected by unobserved variables (Altonji et al., 2005). Finally, we perform placebo tests showing that changes in abstinence mandates do not affect birth rates for women who graduated from high school prior to the policy change. This provides further support for the assumption that teen health outcomes would have changed similarly across adopting and non-adopting states, absent the change in policy.

Our results generally indicate that state-level abstinence mandates have no effect on teen birth rates, STD rates, or teen abortion rates. Importantly, this result holds even for the youngest group, 15–17-year-olds, who were less likely than 18–19-year-olds to be either sexually active or exposed to sex education before the adoption of the policy. We present some evidence, though, that abstinence mandates may increase teen sexually transmitted disease rates in states that had no policies in effect prior to mandating abstinence curricula.

The primary contributions of our paper are twofold. First, we are the first to our knowledge to use a quasi-experimental research design to estimate the impact of abstinence-based sex education on teen birth rates, STD rates and abortion rates using state-level data representing broad populations of interest. Second, our study speaks directly to the effectiveness of an important policy parameter—state mandates—and, in doing so, informs the policy debate as to the consequences of these laws. Indeed, our study suggests that while the political and financial costs of abstinence policies are quite high, teens do not appear to be reaping

any benefits with respect to sexual health.⁴

2 State-Level Sex Education Policies

About 90% of schools taught some form of sex education from 2006–2008, and 96% of teens reported having some sort of formal sex education before they turned 18 (Martinez et al., 2010). The existence of formal sex education in schools is overwhelmingly supported by parents (Ito et al., 2006; Santelli et al., 2006), and is linked to less risky teen sexual behavior, decreases in teen births (Cavazos-Rehg et al., 2012) and increases in the use of contraception (Mueller et al., 2008; Kirby, 2007).⁵

Over the past two decades, state policies have propelled the shift to more abstinence-based sex education. In 1996, as part of the Welfare Reform Act, the federal government increased abstinence funding for states by \$50 million per year with the creation of the Title V abstinence-only-until-marriage program.⁶ The inception of abstinence-based funding created incentives for the enactment of state-level abstinence-based sex education mandates. Since the onset of Title V, such mandates have been upheld in over 20 states and have been adopted in 6 states (Alan Guttmacher Institute).

Importantly, there is a significant body of research demonstrating that superintendents

⁴For example, in 2011 alone nearly \$200 million was given to states for sex education programs (SIECUS, 2013).

⁵See Kirby (2002) and Kirby (2008) for an excellent and thorough review of this literature. Generally, researchers find that sex education does not hasten the onset of teen sexual intercourse, nor does it increase the number of sexual partners or frequency.

⁶Title V funds are tied to an eight-point policy which strictly defines “abstinence education.” Section 510 (b) of Title V of the Social Security Act, P.L. 104-193 defines abstinence education as follows: Abstinence education has as its exclusive purpose teaching the social, psychological, and health gains to be realized by abstaining from sexual activity, teaches abstinence from sexual activity outside marriage as the expected standard for all school-age children, teaches that abstinence from sexual activity is the only certain way to avoid out-of-wedlock pregnancy, sexually transmitted diseases, and other associated health problems, teaches that a mutually faithful monogamous relationship in the context of marriage is the expected standard of sexual activity, teaches that sexual activity outside of the context of marriage is likely to have harmful psychological and physical effects, teaches that bearing children out-of-wedlock is likely to have harmful consequences for the child, the child’s parents, and society, teaches young people how to reject sexual advances and how alcohol and drug use increase vulnerability to sexual advances, and teaches the importance of attaining self-sufficiency before engaging in sexual activity. All programs that receive these funds are obliged to teach what is specified in these points (SIECUS).

and teachers follow state-level sex education mandates, which suggests that these policies are affecting the sex education content that students receive in the classroom (e.g. Landry et al., 1999; Darroch et al., 2000; Gold and Nash, 2001; Forrest and Silverman, 1989; Muraskin, 1986; Moore and Rienzo, 2000; Sonfield and Gold, 2001).⁷ Thus, there is every reason to believe that state-level mandates regarding changes in sex education content could have effects on teen health outcomes.

3 Data

We use state-level policy data on mandated sexual education curriculum from monthly reports from the Alan Guttmacher Institute (AGI). Since 2000, AGI has assessed the language of every state-level sexual education mandate to determine whether the state requires educators to “stress” or “cover” abstinence and/or contraception. We adopt this terminology throughout this paper for consistency.

We consider a state to be treated if a stress-abstinence policy was enacted during 2000–2011. Five states meet these criteria and serve as the treatment group. These states include Maine, Michigan, Washington, Wisconsin and Colorado.⁸ The five adopting states mandate that school districts emphasize monogamous sexual relations with a spouse as the most effective way to prevent unintended pregnancy and STDs, although some variation in the requirements of these policies exists across states.⁹ See Table 1 for more details on the content requirements and policy language of each treatment state’s stress abstinence policy.

We use the twenty-one states that maintained comprehensive sex education policies

⁷For example, in 1997, a school board in North Carolina ordered that chapters containing information on contraception and sexually transmitted diseases be deleted from its 9th grade textbooks in order to comply with a new state law that required educators to stress abstinence (Donovan, 1998).

⁸New Jersey added a stress-abstinence policy in 2002 but switched back to a comprehensive program in 2006. Therefore it is dropped from all further analysis. When included as a treatment state, we find a statistically insignificant effect of -0.3 percent, which corresponds to the estimate of 1.2 percent reported in Panel A Column 5 of Table 3. These estimates are not statistically different at the 99% level.

⁹Colorado does not mandate schools to teach sex education, but does require educators to stress abstinence when it is taught. Nearly 80% of Colorado high schools in 2008 taught pregnancy prevention and the benefits of being sexually abstinent in a required health class (Brener et al., 2009), which suggests that many schools choose to teach sex education even when it is not mandated.

throughout 2000–2011 as the control group.¹⁰ States are considered to have a comprehensive policy if abstinence is covered but not stressed or if contraception education is mandated either in STD or sex education. We use this subset of states as a control group since it improves the match on trends prior to the enactment of the sex education policy for our treatment states.^{11,12}

The data source for birth data for various age groups during the sample period is the National Center for Health Statistics (NCHS), Division of Vital Statistics natality files.¹³ One advantage of using the natality files is that the administrative nature of these data allows for more reliable estimates than self-reported behavioral data. Additionally, we use state-level teen STD data, comprised of the total number of gonorrhea, chlamydia, and syphilis cases per year, from the online, publicly-available Centers for Disease Control and Prevention (CDC) Atlas. Rates for each health measure were calculated using the number of cases per 1,000 relevant individuals.¹⁴ It is important to note that these STD data account for only reported STDs. If STD testing rates are affected by the change in sex education requirements, then the results may not speak to the underlying change in STD rates directly. If abstinence-based sex education reduces testing by increasing the stigma surrounding such diseases, this would attenuate our results towards zero.

We use data on abortion rates by age from yearly state-level estimates reported by the CDC Abortion Surveillance System. The CDC is the only source to publish annual estimates

¹⁰These states are: Alabama, California, Connecticut, Delaware, Florida, Georgia, Hawaii, Illinois, Kentucky, Maryland, Missouri, New Mexico, New York, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, Vermont, Virginia, and West Virginia.

¹¹This approach is similar in spirit to synthetic control methods (Abadie and Gardeazabal, 2003) in which a more similar group of non-treated states (based on pre-treatment data) is selected as the control group for a single treated state in order to reduce the potential for bias.

¹²See Tables A1-A3 in the appendix for a complete replication of our main findings using all non-treated states as controls. Note that some of the coefficients for the leading indicator variables in Column 9 in Table A1 and Columns 6 and 9 in Table A2 are statistically different from zero, suggesting that trends for control and treatment groups are diverging prior to treatment. We can therefore assume that the model using all states is misspecified and is inappropriate for any analysis which utilizes a difference-in-differences methodology.

¹³Birth data aggregated by state is publicly available via the online CDC Wonder database.

¹⁴In particular, for the teen birth rate, we calculate the number of births to females aged 15-19, multiply by 1,000, and divide by the state population of females aged 15-19. To calculate STD rates, we used the entire teen population aged 15-19.

on abortion rates by state and age group. Unfortunately, these data are currently available only up to 2009. Because centers are not required by law to annually submit abortion data, there are some inconsistencies within these estimates. Therefore, we omit eleven states that either had missing observations during the sample period or experienced unusual spikes or declines of over 30% in teen abortion rates.^{15,16} We attribute these large fluctuations to errors in reporting and deliberate omissions by multiple states, which is a well-documented occurrence in this data (Blank et al., 1996).

To control for the effects of economic factors and race, we use annual data from the Census Bureau Current Population Survey (CPS) and the Bureau of Labor Statistics (BLS) on median family income and unemployment rates by state, respectively. Population data from the Census Bureau provided gender-specific estimates for the number of white, black, and Hispanic teens in each state.

In order to directly control for changes in abortion legislation or policies that might be correlated with abstinence-based education, we use annual report card data published by NARAL Pro-Choice America. These data contain state-level rankings and standard letter grades based on multiple variables that serve as proxies for a woman’s legal ability to seek out an abortion. “A+” states are those with the most relaxed abortion laws, while “F” states have the most restrictive abortion laws. We use these data to construct yearly “abortion grade” dummy variables for each state to serve as a measure of abortion access.¹⁷

Altogether, we construct a state-level, 12-year panel spanning from 2000–2011. Summary statistics are presented in Table 2. Birth rates across treatment and control states average 39 per 1,000 teenage females over the sample period, with the younger cohort, teens aged 15–17, responsible for nearly half. STD rates across states average approximately 21 per 1,000 teens,

¹⁵The states that were dropped for abortion models include: California, Colorado, Delaware, Florida, Illinois, Kentucky, Maryland, New York, Rhode Island, Vermont and West Virginia.

¹⁶Our results are not sensitive to this omission. When including these states in our model, we estimate a statistically insignificant effect of -0.9%, which corresponds to the our estimate of -2.7% in Column 5 of Table 6. These estimates are statistically similar at the 99% level.

¹⁷Due to the wide variation of possible grades, we eliminate the plus or minus signs for simplicity. For example, we consider a state that received a grade of “A-”, “A”, or “A+” to be an “A” state.

with a standard deviation of 7.3. Teen abortions average 15 per 1,000 females, although, as previously mentioned, this is expected to be underestimated (Blank et al., 1996).

4 Methods and Identification

4.1 Difference-in-Differences Model

In order to identify the causal effect of state-mandated sex education policies, we exploit the within-state variation in the adoption of stress-abstinence laws. The main identifying assumption of our difference-in-differences approach is that outcomes in adopting states would have changed in a way similar to control states if they had not changed their law. We compare states that added a stress-abstinence policy from 2000–2011 to states whose sex education policies are most similar to those of the treatment states before the change in policy, as explained in Section 3, and we test this identification assumption multiple ways (which we describe in Section 4.2). Formally, we estimate the following equation:

$$y_{it} = \beta \textit{abstinence policy}_{it} + \gamma X_{it} + \alpha_i + \lambda_t + u_{it} \quad (1)$$

where y_{it} measures teen health outcomes such as logged birth rates, logged abortion rates, and logged STD rates, $\textit{abstinence policy}_{it}$ is a dummy variable equal to one when a treated state i has an abstinence-based sex education policy in year t , and X_{it} is a vector of control variables including teen racial demographics, a measure of abortion access, and state-level economic variables including median family income and unemployment rates.¹⁸ State and

¹⁸Our identifying assumption for a model with logged outcomes is that in the absence of the stress-abstinence policy, treatment states would have had a similar proportionate change in birth rates, STD rates, and abortion rates as compared to control states. Since we are using state-level data, we are more comfortable with the assumption of an increase in relative rates rather than absolute rates. This makes a practical difference since, for example, a 10% decline in the teen birth rate in Maine represents an absolute decrease of about 2.5 births per 1,000 teen females, while a 10% decline in Arizona represents a decrease of about 7 births per 1,000 teen females. Our results are not sensitive to this assumption. When estimating effects on birth rates, we get a statistically insignificant effect of 0.74, or 1.9%, which corresponds to the 1.2% effect of logged birth rates reported in Table 3 Panel A Column 5. These estimates are not statistically different at the 99% level. See Tables A4–A6 for a complete replication of the main estimates without logging

year fixed effects, α_i and λ_t , are added to control for time-invariant, state-level confounders and time-varying shocks to teen health outcomes that are constant across states, respectively. Robust standard errors are clustered at the state level to allow for shocks to be correlated within states over time.¹⁹

We estimate effects of stress abstinence policies on teen health outcomes using unweighted ordinary least squares, weighted least squares and Poisson models.²⁰ There is large variation in female teen population across states, and using weighted least squares increases precision and allows us to observe heterogeneous treatment effects. Moreover, to check that our results are not sensitive to one particular specification, we report results from a fixed effects Poisson model to account for the count nature of birth data.

Additionally, we estimate the following model which contains leading and lagged indicator variables:

$$y_{it} = \beta_0 \textit{policy enacted}_{it} + \beta_1 \textit{policy enacted}_{it-1} + \dots + \beta_4 \textit{policy enacted}_{it-4} + \delta_1 \textit{policy enacted}_{it+1} + \delta_2 \textit{policy enacted}_{it+2} + \gamma X_{it} + \alpha_i + \lambda_t + u_{it} \quad (2)$$

where y_{it} measures teen health outcomes such as logged birth rates, logged abortion rates, and logged STD rates, $\textit{policy enacted}_{it-k}$ is a dummy variable equal to one when a treated state i enacted an abstinence-based sex education policy in year $t - k$. For positive values of k , the regressor is a lagged treatment effect, and for negative values of k , it is a leading indicator. In the year of enactment, k is zero, and β_0 is the immediate effect of treatment.

This policy may have a delayed effect if, for example, an effect was only present for the dependent variables.

¹⁹Our conclusions remain unchanged when estimating models using a wild bootstrap-t method to account for our relatively small number of clusters. For example, the p-value for Table 3 Panel A Column 5 when clustering is 0.62, compared to a p-value of 0.60 when using the wild bootstrap method.

²⁰Specifically, we use analytic weights where the weight for teen birth rates and teen abortion rates is the average state teen female population from 2000–2011, and the weight for teen STD rates is the average state teen population from 2000–2011.

teens who had never received sex education instruction before the policy. We include lagged indicator variables for each of the first 4 years after enactment. Some states treated later do not have more than 4 years after enactment in the panel due to their enactment year. For this reason, we create a lag denoting that enactment occurred four or more years before (the 4+ years lag).

4.2 Identification

We estimate the leading indicators in Equation (2) to formally test for divergence of the treatment and control groups before the treatment actually occurred. If the coefficients on the leads were not zero, it would suggest that the control and treatment groups were not on the same trajectory before treatment, which would lead us to question our identification assumption. Additionally, we plot the coefficients for the leading indicators to graphically demonstrate that adopting states closely tracked control states prior to the policy change. Furthermore, we check whether the difference-in-differences estimates change significantly with the addition of control variables. Intuitively, we ask whether observable time-varying factors appear to be correlated with the within-state policy adoption. To the extent that estimates are unaffected by the inclusion of observable factors such as access to abortion, unemployment rates, and median family income, it gives us some comfort that estimates will not be subject to omitted variable bias.

5 Results

Before presenting model-based estimates, we first show a graphical analysis that corresponds to our difference-in-differences identification strategy. Figure 1 graphs the estimated lags and leads from Equation (2) to test for the divergence in trends between treatment and control groups prior to the abstinence mandate. Figure 1a corresponds to the weighted least squares model for logged teen birth rates which includes state and year fixed effects as well as

economic and demographic controls. The coefficients for the leads (the points to the left of the vertical line) are all close to zero, which indicates that the treatment and control groups were not diverging prior to treatment. Figures 1b and 1c similarly graph the estimates over time for logged teen sexually transmitted disease rates and abortion rates, respectively, and show that the trends in health outcomes for the treatment states similarly track trends in health outcomes in the comparison states prior to the policy change, lending some support to our identification assumption. Finally, all graphs show an estimated zero effect on teen health outcomes after the adoption of stress-abstinence sex education mandates, which we further investigate in the discussion of results below.

5.1 Effects on Teen Birth Rates

Table 3 presents estimates of the effect of a stress-abstinence mandate on logged teen birth rates based on OLS, WLS and Poisson models, as described by Equation (1). Panel A presents the average treatment effect from a difference-in-differences model, while Panel B presents estimates from models that include lagged and leading indicator variables. Column 1 displays estimated effects from a baseline OLS model, while Column 2 shows the estimated effects from an OLS model that adds controls for state-level race and economic variables, as well as a measure of abortion access. We note that estimates change little when we include time-varying controls, which suggests there may be little scope for omitted, unobserved factors to bias our estimates. Estimates from these two columns indicate that the policy change had no effect on teen birth rates. Column 3 includes a specification that additionally controls for one- and two-year leading indicator variables, which serves as an additional check on our identifying assumption. These coefficients are all statistically insignificant and close to zero, and their addition does not cause the coefficient of interest to change significantly, suggesting that the identification assumption is likely valid.

Columns 4-6 repeat this exercise for a weighted least squares model. These estimates address the possibility that estimates from the baseline OLS model may be imprecise if

the variance of the error terms are proportional to the number of teen females in a given state. Therefore, we weight the estimates by the average state-level teen female population, and display both average and dynamic treatment effects in Columns 4, 5 and 6. Across all columns, none of the estimates are statistically different from zero.

Finally, Columns 7-9 utilize a Poisson fixed effects model to account for the discrete nature of natality data. Although Poisson models are typically used to estimate counts and not rates, we note that this model can be alternatively expressed as one that estimates the natural log of the expected count of teen births while controlling for the population of teen females and constraining its coefficient to be equal to one. This allows us to create estimates that are analogous to the weighted least squares estimates shown in Columns 4-6. Across columns, all estimates are statistically insignificant.

There is little evidence that state-level abstinence policies affect teen birth rates. Importantly, estimates for our preferred specification in Panel A Column 5 are sufficiently precise to rule out large effects in teen birth rates. For example, the 95% confidence interval lower bound and upper bound are -3.7% and 6.1%, respectively. The 90% confidence interval falls between -2.9% and 5.3%.

5.2 Effects on Teen STD Rates

Behavioral changes may also cause changes to sexually transmitted disease (STD) rates, especially if students are less knowledgeable about other forms of contraception as a result. In order to examine these effects, we estimate the same difference-in-differences model for logged teen STD rates and report the results in Tables 4 and 5.

Weighted least squares estimates in Table 4 indicate that abstinence mandates have no effect on STDs. All leading indicators and lags are statistically indistinguishable from zero. However, unweighted OLS estimates in Columns 1-3 reveal an increase in STD rates for the year of enactment and the following few years. These contradicting results can signal heterogeneous effects across states of different sizes (Solon et al., 2013), and smaller states

are more likely to be driving the perceived increase.

To explore this heterogeneity, in Table 5 we replicate Table 4 using only our smallest treatment states (Maine and Colorado) as the treatment group. The effects for these two states are quite stark as we find a significant positive effect on STDs of 10% overall and between 10% and 14% for the year of enactment and the following two years. Neither of these states had any sex education requirements before their abstinence mandates were enacted. Along with social and idiosyncratic differences between states, this policy difference may have contributed to the effects reported in Table 4.²¹ The heterogeneous effects could suggest that students who have never been exposed to comprehensive sex education are more likely to exhibit higher STD rates due to the enactment of abstinence-based sex education mandates. Thus, this finding could be indicative of increased risky sexual behavior and/or higher transmission rates due to increased stigma of STD screening and treatment.

5.3 Effects on Teen Abortion Rates

Abstinence-based sex education may also affect teen abortion rates, either through changing the number of unintended pregnancies or increasing stigmatization of abortions. We empirically assess this hypothesis by estimating Equations (1) and (2) for logged teen abortion rates.

Results for logged teen abortion rates are shown in Table 6.²² Average effects, shown in Panel A, range from -3.9% to 0%, and all are statistically insignificant. Estimates are similar in Panel B, and all are statistically insignificant at the 95% confidence level. Overall, results suggest that teen abortion rates also seem to be unaffected by sex education policy changes.

²¹When estimating our model without these two treatment states, we find a statistically insignificant effect of 1.2%, which corresponds to the 2.5% estimate reported in Panel A Column 5 of Table 4. These estimates are statistically indistinguishable at the 99% level.

²²The regressions for Table 6 account for a smaller subset of states since many states do not consistently or accurately report teen abortion data. The states that are dropped for these regressions include: California, Colorado, Delaware, Florida, Illinois, Kentucky, Maryland, New York, Rhode Island, Vermont and West Virginia due to data fluctuations and inconsistencies. See section 3 for a more detailed explanation. Our results are not overly sensitive to this selection. See Table A7 for a replication of Table 6 when these 11 states are included in the analysis.

6 Subgroup Analysis

Teen birth rates are commonly measured for the 15–19-year-old age group, and we follow this convention in the above analysis. However, if sex education policies do change teen behavior, younger teens who may have not been sexually active or exposed to sex education before the adoption of policy are more likely to be affected.²³ Most 18– and 19-year-olds are not in high school any longer and would not have been exposed to the curriculum. Additionally, 18– and 19-year-olds who attend college are arguably exposed to a different sexual culture that could counteract their high school sex education training.

In Columns 1-4 of Table 7, we consider logged birth rates for 15–17-year-olds and 18–19-year-olds separately to determine if younger and older teens respond differently to the stress-abstinence policies. Panel A reports unweighted results, Panel B reports weighted results, and Panel C reports results from a Poisson model. For both age groups, estimates from all model specifications are statistically insignificant and close to zero. Even for the younger age group, who are most likely to be affected by the policy, we are able to rule out large effects. The 95% confidence interval for the estimate in Panel B Column 2 is bound by -5.1% and 5.5%, and the 90% confidence interval is -4.2% to 4.7%. This echoes the main findings and rules out the possibility that insignificant effects for the older group are washing out a measurable effect on the younger group.

While we address potential bias above by directly controlling for time-varying factors such as access to abortion and economic conditions, here we offer an additional test to ensure that other state-level conditions affecting fertility did not also change at the time of treatment. Specifically, we estimate policy effects on the logged birth rates of women between the ages of 30–34. These women were just old enough during the sample period to not have been in the teen population in 2000, and therefore could not have been affected by the policy changes. Thus, if the fertility of these women appears to have been affected by the policy

²³For example, Cannonier (2012) finds that state-level abstinence funding affects only white teens aged 15–17.

change, then it would suggest that our identifying assumption was violated.

The results for women aged 30–34 are shown in Columns 5 and 6. Estimates range from -0.5% to 0.0% and are not statistically different from zero. This finding is consistent with our identifying assumption and suggests that there was no other state-level determinant that changed at the time of the policy that affected fertility more generally. Additionally, Table A8 provides estimates from a triple differences model in which we use the state-level population of teen females as a within-state control group to net out the state’s secular trend in birth rates. These estimates further emphasize that general fertility levels were not changing systematically at the time of the policy changes.

Due to the differences in average teen birth rates by race and ethnicity, we may expect to observe heterogenous effects of abstinence intervention programs by these attributes. Panels D, E and F present the weighted and unweighted least squares estimates for the effect of stress-abstinence policies on logged birth rates for white, black, and Hispanic teens, by column. Mirroring previous results, we find no policy effects for any subgroup.

7 Discussion and Conclusion

Many politicians, activists, and child development scientists have argued that the content of sex education in public schools is an important factor in teen sexual health outcomes such as birth rates, STD rates and abortion rates. This paper adds to this discussion by considering how state-mandated abstinence-based sex education affects teen health outcomes. We show empirically that adopting or switching to a stress-abstinence policy does not have an effect on teen birth rates or abortion rates. However, state-level policies may increase STD rates in states with relatively small populations. Our findings rule out any effects greater than 2 births per 1,000 teens, or a 6% change in teen birth rates. This suggests state policies are relatively ineffective at reducing unintended pregnancy as compared to pregnancy prevention programs, increases in contraception access, or media interventions, which have been reported

to decrease teen birth rates by 6% to 25% in the short run (Thomas, 2012; Lindo and Packham, 2015; Guldi, 2008; Kearney and Levine, 2014). While we can rule out large effects, we cannot dismiss modest effects of abstinence sex education on teen pregnancy. Our findings fit into a greater literature on the general ineffectiveness of state policies as a tool for reducing teen pregnancy. Recent research shows that policies such as oral contraceptive access, welfare reform and family planning services similarly result in little to no reduction in teen pregnancy (Myers, 2012; Kearney, 2004; Kearney and Levine, 2009).

One might be concerned that the reason that stress abstinence mandates have no effect is because they do not actually affect the material being taught in the classroom. However, survey evidence suggests that superintendents and teachers take action to follow mandates (Landry et al., 1999; Darroch et al., 2000; Gold and Nash, 2001). A more likely explanation is that the change in classroom instruction did not change teens' knowledge about sex. For example, evidence from surveys suggests that parents are strongly opposed to politicians choosing sex education content and prefer that the choice be delegated to health care professionals and teachers (Ito et al., 2006). Therefore, it is reasonable to believe that parents, churches and community groups may fill in the gaps when sex education curriculum changes. Alternatively, it could be that teens' knowledge of sex does change after the policy, but that teen behavior is simply unresponsive to that knowledge.

Regardless of the mechanism underlying our main findings, our results indicate that teen pregnancy is unresponsive to mandated changes to sex education curriculum. Moreover, as teen birth rates continue to decline over time, it will become increasingly more difficult for policy levers to reduce unintended pregnancy rates. Millions of dollars are at stake each year based on what a state decides to mandate, and this topic is often at the center of political battles. Thus, our study provides suggestive policy implications for the future allocation of state-level political resources and abstinence-based sex education funding.

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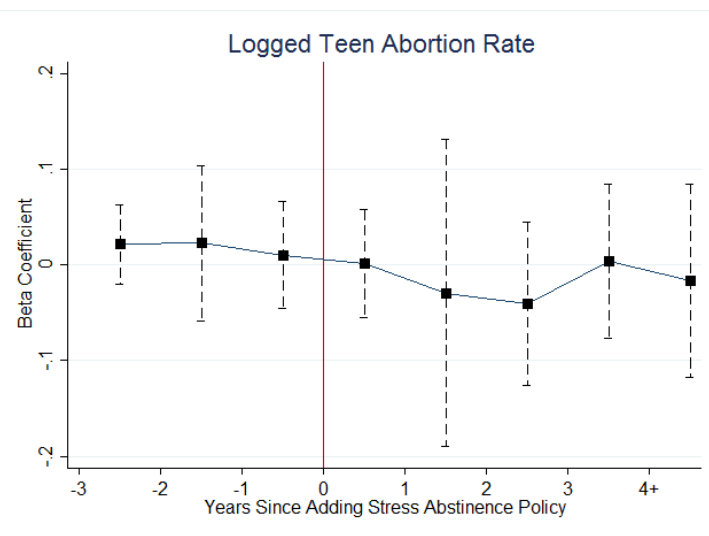
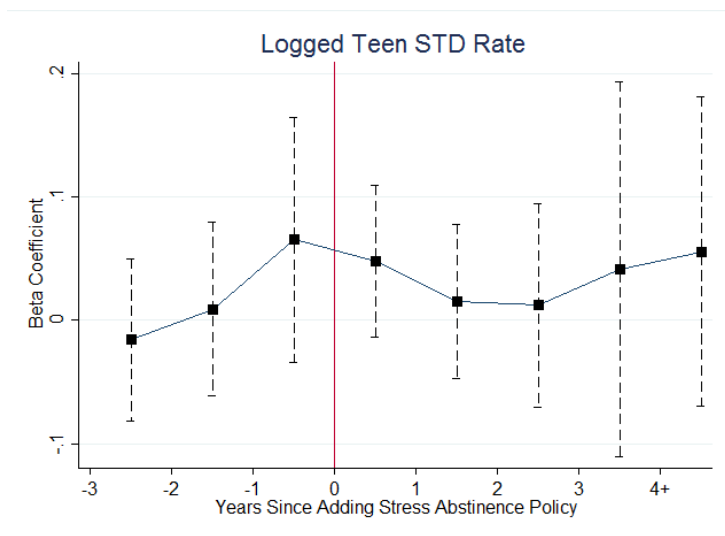
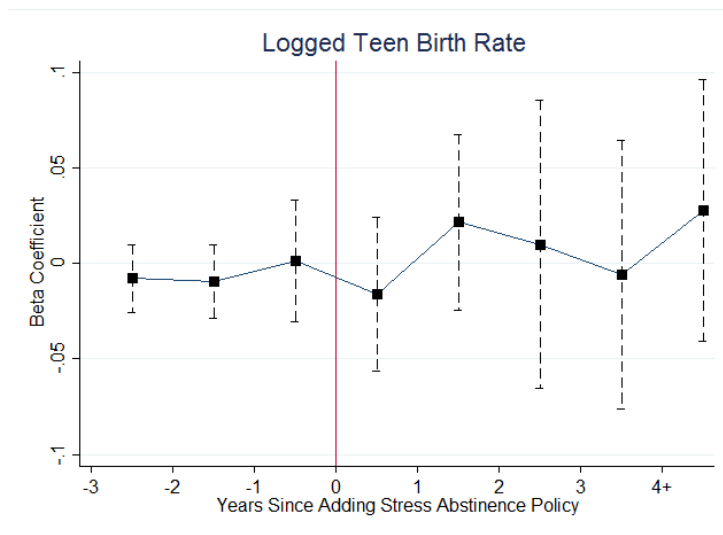
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Figure 1: Divergence in Teen Health Outcomes Before and After Adoption of a Stress-Abstinence Policy, Relative to the Difference 3 or More Years Before Adoption



Notes: The figure displays the coefficients and their 95% confidence intervals for the leading indicators and lagged treatment effects from weighted least squares regressions, accounting for state and year fixed effects and covariates. Full results from these regressions are shown in Panel B Column 6 in Tables 3, 4 and 6. The control variables include percent of females ages 15-19 who are black, percent of females ages 15-19 who are Hispanic, a policy-based measure of abortion access, state unemployment rates and median family income.

Table 1: Policy Summary of States that Enacted a Stress Abstinence Mandate from 2000-2011

State	Effective Year	Stress Abstinence	Cover Contraception	Sex/STD Ed. Mandated	Previous Policy
Maine	2002	Yes	Yes	Yes	No Content Requirements
Michigan	2005	Yes	No	Yes	Comprehensive
Wisconsin	2006	Yes	No	Yes	No Content Requirements
Washington	2006	Yes	Yes	Yes	Comprehensive
Colorado	2007	Yes	Yes	No	No Content Requirements

Policy Language of States that Enacted a Stress Abstinence Mandate from 2000-2011

State	Effective Year	Stress Abstinence Policy Language
Maine	2002	Sex education “promotes responsible sexual behavior with an emphasis on abstinence ; addresses the use of contraception; promotes individual responsibility and involvement regarding sexuality; and teaches skills for responsible decision making.”
Michigan	2005	Teachers must “ stress that abstinence from sex is a responsible and effective method for restriction and prevention of these diseases and is a positive lifestyle for unmarried young people... Instruction must stress the benefits of abstinence but districts are not prohibited from teaching about behavioral risk reduction strategies, including the use of condoms, within a sex education program.”
Wisconsin	2006	“Presents abstinence from sexual activity as the preferred choice of behavior for unmarried pupils. Emphasizes that abstinence from sexual activity before marriage is the only reliable way to prevent pregnancy and sexually transmitted diseases, including human immunodeficiency virus and acquired immunodeficiency syndrome.”
Washington	2006	“All sexual health education programs must include an emphasis on abstinence as the only one hundred percent effective means of preventing unintended pregnancy, HIV and other sexually transmitted diseases.”
Colorado	2007	“The curriculum must fulfill the following requirements: ... (2) Emphasize abstinence (as defined in the statute) and teach that it is the only certain way to avoid pregnancy...”

Notes: Alan Guttmacher Institute provided data on state-level sex education policies from 2000-2011. Comprehensive policies require that schools teach both abstinence and contraception as methods to prevent pregnancy. Wisconsin eventually added a cover contraception policy in 2010, 4 years after the stress abstinence policy went into effect. Data on state policy language was provided by the National Association of States Boards of Education Center for Safe and Healthy Schools.

Table 2: Summary Statistics

	Mean	St. Dev.
Outcome Variables		
Births per 1,000 females aged 15-19	38.8	11.4
Births per 1,000 females aged 15-17	20.2	6.8
Births per 1,000 females aged 18-19	66.6	18.9
Births per 1,000 females aged 30-34	92.5	11.2
STDs per 1,000 Teens	20.6	7.3
Abortions Rate per 1,000 females aged 15-19	14.9	7.1
Births per 1,000 Black females aged 15-19	52.7	17.6
Births per 1,000 White females aged 15-19	23.7	11.1
Births per 1,000 Hispanic females aged 15-19	92.8	45.0
Control Variables		
Median Family Income	47,227	7,575
Teen Unemployment Rate	18.3	5.5
Percent Black Teens	0.15	0.11
Percent White Teens	0.72	0.15
Percent Hispanic Teens	0.13	0.14
NARAL Grade A	0.35	0.48
NARAL Grade B	0.10	0.30
NARAL Grade C	0.08	0.27
NARAL Grade D	0.19	0.39
NARAL Grade F	0.30	0.46

Notes: We use birth data for various age groups during the sample period from the National Center for Health Statistics (NCHS), Division of Vital Statistics natality files via the online CDC Wonder database. State-level teen STD data, comprised of the total number of gonorrhea, chlamydia, and syphilis cases per year, are from the online, publicly available Centers for Disease Control and Prevention (CDC) Atlas. We use abortion data by age from yearly state-level estimates reported by the CDC Abortion Surveillance System. NARAL Pro-Choice America report card data contain proxies for legal abortion access. “A” states are those with the most relaxed abortion laws, while “F”s are given to the states with the most restrictive abortion laws.

Table 3: Effect of Stress-Abstinence Policy on Logged Teen Birth Rates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	OLS	OLS	OLS	WLS	WLS	WLS	Poisson	Poisson	Poisson
Panel A. Average Effects									
Abstinence Mandate in Effect	-0.006 (0.026)	-0.002 (0.026)	-0.005 (0.031)	0.016 (0.021)	0.012 (0.025)	0.012 (0.026)	0.006 (0.020)	0.002 (0.023)	-0.000 (0.024)
1 Year Prior to Enactment			-0.007 (0.018)			0.004 (0.016)			-0.000 (0.015)
2 Years Prior to Enactment			-0.008 (0.015)			-0.007 (0.008)			-0.010 (0.008)
Panel B. Dynamic Effects									
Effect of Policy in Year of Enactment	-0.028* (0.016)	-0.023 (0.018)	-0.027 (0.024)	-0.016 (0.016)	-0.013 (0.017)	-0.014 (0.018)	-0.022 (0.014)	-0.023 (0.016)	-0.025 (0.017)
1 Years After Enactment	0.002 (0.021)	0.019 (0.017)	0.015 (0.020)	0.017 (0.022)	0.024 (0.021)	0.024 (0.021)	0.009 (0.020)	0.014 (0.019)	0.012 (0.019)
2 Years After Enactment	-0.016 (0.031)	-0.011 (0.032)	-0.015 (0.036)	0.011 (0.032)	0.013 (0.035)	0.012 (0.036)	-0.000 (0.031)	0.001 (0.033)	-0.001 (0.033)
3 Years After Enactment	-0.020 (0.031)	-0.017 (0.034)	-0.020 (0.037)	0.002 (0.027)	-0.003 (0.032)	-0.004 (0.033)	-0.008 (0.026)	-0.015 (0.030)	-0.018 (0.031)
4+ Years After Enactment	0.016 (0.033)	0.012 (0.037)	0.009 (0.041)	0.041 (0.027)	0.030 (0.030)	0.030 (0.033)	0.034 (0.028)	0.023 (0.030)	0.021 (0.032)
1 Year Prior to Enactment			-0.009 (0.019)			0.004 (0.015)			-0.001 (0.015)
2 Years Prior to Enactment			-0.008 (0.016)			-0.007 (0.008)			-0.011 (0.009)
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Estimates are based on annual data for 26 states from 2000-2011. Each column by panel represents coefficients from a separate regression. Robust standard errors are clustered at the state level and are shown in parentheses. The control variables include percent of females ages 15-19 who are black, percent of females ages 15-19 who are Hispanic, a policy-based measure of abortion access, state unemployment rates and median family income.

Table 4: Effect of Stress-Abstinence Policy on Logged Teen STD Rates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	OLS	OLS	OLS	WLS	WLS	WLS	Poisson	Poisson	Poisson
Panel A. Average Effects									
Abstinence Mandate in Effect	0.042 (0.047)	0.057 (0.038)	0.074* (0.041)	0.022 (0.055)	0.025 (0.038)	0.041 (0.042)	0.027 (0.052)	0.034 (0.033)	0.055 (0.040)
1 Year Prior to Enactment			0.043 (0.054)			0.070 (0.047)			0.092** (0.046)
2 Years Prior to Enactment			0.035 (0.024)			0.014 (0.027)			0.009 (0.022)
Panel B. Dynamic Effects									
Effect of Policy in Year of Enactment	0.053 (0.033)	0.066** (0.027)	0.084** (0.031)	0.044 (0.031)	0.035 (0.027)	0.053 (0.032)	0.047* (0.029)	0.037 (0.025)	0.059* (0.033)
1 Years After Enactment	0.044 (0.041)	0.066 (0.039)	0.083** (0.039)	0.006 (0.036)	0.004 (0.035)	0.020 (0.033)	-0.001 (0.032)	-0.006 (0.033)	0.014 (0.030)
2 Years After Enactment	0.040 (0.045)	0.057 (0.036)	0.076* (0.039)	0.004 (0.044)	0.000 (0.035)	0.017 (0.039)	-0.005 (0.040)	-0.006 (0.031)	0.015 (0.035)
3 Years After Enactment	0.032 (0.065)	0.047 (0.062)	0.064 (0.064)	0.020 (0.082)	0.031 (0.075)	0.046 (0.079)	0.034 (0.080)	0.051 (0.070)	0.070 (0.076)
4+ Years After Enactment	0.039 (0.064)	0.050 (0.058)	0.066 (0.060)	0.027 (0.087)	0.045 (0.064)	0.060 (0.067)	0.039 (0.075)	0.072 (0.051)	0.092 (0.058)
1 Year Prior to Enactment			0.044 (0.053)			0.070 (0.047)			0.091** (0.045)
2 Years Prior to Enactment			0.036 (0.025)			0.014 (0.027)			0.009 (0.022)
N	312	312	312	312	312	312	312	312	312
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Estimates are based on annual data for 26 states from 2000-2011. Each column by panel represents coefficients from a separate regression. Robust standard errors are clustered at the state level and are shown in parentheses. The control variables include percent of females ages 15-19 who are black, percent of females ages 15-19 who are Hispanic, a policy-based measure of abortion access, state unemployment rates and median family income.

Table 5: Effect of Stress-Abstinence Policy on Logged Teen STD Rates in Maine and Colorado

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	OLS	OLS	OLS	WLS	WLS	WLS	Poisson	Poisson	Poisson
Panel A. Average Treatment Effects									
Abstinence Mandate in Effect	0.124***	0.098***	0.098***	0.095**	0.054	0.045	0.084**	0.048	0.039
	(0.031)	(0.022)	(0.025)	(0.040)	(0.032)	(0.030)	(0.035)	(0.031)	(0.030)
1 Year Prior to Enactment			-0.070			-0.069			-0.061**
			(0.060)			(0.047)			(0.027)
2 Years Prior to Enactment			0.068**			0.018			0.012
			(0.031)			(0.031)			(0.031)
N	276	276	276	276	276	276	276	276	276
Panel B. Dynamic Treatment Effects									
Effect of Policy in Year of Enactment	0.106***	0.096***	0.096***	0.089***	0.042	0.031	0.081***	0.023	0.013
	(0.019)	(0.024)	(0.030)	(0.021)	(0.033)	(0.031)	(0.020)	(0.027)	(0.026)
1 Years After Enactment	0.146***	0.148***	0.148***	0.132***	0.111***	0.101**	0.131***	0.111***	0.102***
	(0.022)	(0.020)	(0.029)	(0.034)	(0.038)	(0.037)	(0.032)	(0.039)	(0.036)
2 Years After Enactment	0.137***	0.119***	0.118***	0.116**	0.054	0.043	0.108***	0.040	0.030
	(0.030)	(0.035)	(0.039)	(0.042)	(0.052)	(0.051)	(0.040)	(0.049)	(0.049)
3 Years After Enactment	0.109*	0.081*	0.083**	0.060	0.029	0.019	0.040	0.006	-0.004
	(0.054)	(0.040)	(0.039)	(0.054)	(0.052)	(0.047)	(0.045)	(0.043)	(0.040)
4+ Years After Enactment	0.122**	0.052	0.051	0.081	0.037	0.026	0.061	0.056	0.046
	(0.046)	(0.033)	(0.040)	(0.058)	(0.040)	(0.047)	(0.046)	(0.035)	(0.036)
1 Year Prior to Enactment			-0.069			-0.070			-0.064***
			(0.057)			(0.046)			(0.025)
2 Years Prior to Enactment			0.069*			0.016			0.009
			(0.035)			(0.032)			(0.031)
N	276	276	276	276	276	276	276	276	276
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Estimates are based on annual data for 23 states from 2000-2011. Each column by panel represents coefficients from a separate regression. Robust standard errors are clustered at the state level and are shown in parentheses. The control variables include percent of females ages 15-19 who are black, percent of females ages 15-19 who are Hispanic, a policy-based measure of abortion access, state unemployment rates and median family income.

Table 6: Effect of Stress-Abstinence Policy on Logged Teen Abortion Rates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	OLS	OLS	OLS	WLS	WLS	WLS	Poisson	Poisson	Poisson
Panel A. Average Effects									
Abstinence Mandate in Effect	-0.038	-0.039	-0.034	-0.032	-0.027	-0.023	-0.013	-0.008	0.000
	(0.038)	(0.034)	(0.041)	(0.043)	(0.035)	(0.042)	(0.029)	(0.024)	(0.028)
1 Year Prior to Enactment			0.013			0.004			0.018
			(0.022)			(0.022)			(0.021)
2 Years Prior to Enactment			0.009			0.015			0.024
			(0.032)			(0.034)			(0.028)
Panel B. Dynamic Effects									
Effect of Policy in Year of Enactment	-0.041*	-0.034	-0.029	-0.017	-0.009	-0.005	-0.006	0.002	0.011
	(0.022)	(0.023)	(0.031)	(0.022)	(0.019)	(0.025)	(0.020)	(0.015)	(0.019)
1 Years After Enactment	-0.072	-0.069	-0.064	-0.047	-0.040	-0.036	-0.012	-0.003	0.006
	(0.058)	(0.062)	(0.071)	(0.067)	(0.072)	(0.079)	(0.045)	(0.046)	(0.050)
2 Years After Enactment	-0.052	-0.033	-0.028	-0.072	-0.051	-0.047	-0.050	-0.036	-0.028
	(0.049)	(0.040)	(0.047)	(0.051)	(0.034)	(0.040)	(0.036)	(0.028)	(0.031)
3 Years After Enactment	-0.005	-0.013	-0.009	-0.012	-0.006	-0.002	0.003	0.005	0.013
	(0.047)	(0.028)	(0.036)	(0.050)	(0.030)	(0.038)	(0.033)	(0.022)	(0.027)
4+ Years After Enactment	0.009	-0.042	-0.037	0.022	-0.027	-0.023	0.039	-0.002	0.006
	(0.031)	(0.049)	(0.050)	(0.031)	(0.051)	(0.051)	(0.024)	(0.038)	(0.034)
1 Year Prior to Enactment			0.010			0.003			0.018
			(0.025)			(0.023)			(0.022)
2 Years Prior to Enactment			0.009			0.015			0.024
			(0.033)			(0.034)			(0.029)
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Estimates are based on annual data for 15 states from 2000-2011. Each column by panel represents coefficients from a separate regression. Robust standard errors are clustered at the state level and are shown in parentheses. The control variables include percent of females ages 15-19 who are black, percent of females ages 15-19 who are Hispanic, a policy-based measure of abortion access, state unemployment rates and median family income. Eleven states were removed from the analysis due to missing or inconsistent data. The states that were dropped for these regressions include California, Colorado, Delaware, Florida, Illinois, Kentucky, Maryland, New York, Rhode Island, Vermont and West Virginia.

Table 7: Effect of Stress-Abstinence Policy on Logged Teen Birth Rates for Age and Race Subgroups

	<u>15-17 Year-Olds</u>		<u>18-19 Year-Olds</u>		<u>30-34 Year-Olds</u>	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Ordinary Least Squares						
Abstinence Mandate in Effect	-0.006 (0.027)	-0.005 (0.027)	0.008 (0.031)	0.013 (0.034)	-0.000 (0.016)	-0.000 (0.014)
Panel B. Weighted Least Squares						
Abstinence Mandate in Effect	0.015 (0.023)	0.002 (0.027)	0.034 (0.026)	0.032 (0.031)	-0.005 (0.016)	-0.004 (0.013)
Panel C. Poisson						
Abstinence Mandate in Effect	-0.003 (0.021)	-0.012 (0.024)	0.011 (0.018)	0.001 (0.015)	-0.004 (0.015)	-0.004 (0.012)
	<u>White Teens</u>		<u>Black Teens</u>		<u>Hispanic Teens</u>	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel D. Ordinary Least Squares						
Abstinence Mandate in Effect	-0.034 (0.036)	-0.021 (0.027)	-0.033 (0.046)	-0.030 (0.052)	-0.075 (0.095)	-0.064 (0.110)
Panel E. Weighted Least Squares						
Abstinence Mandate in Effect	0.026 (0.044)	0.007 (0.026)	0.039 (0.041)	0.014 (0.018)	-0.008 (0.042)	-0.014 (0.066)
Panel F. Poisson						
Abstinence Mandate in Effect	-0.014 (0.028)	-0.017 (0.022)	0.033 (0.036)	0.005 (0.013)	-0.016 (0.037)	-0.025 (0.054)
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Estimates are based on annual data for 26 states from 2000-2011. In Panels A, B and C, the dependent variable for Columns 1-2 is the logged birth rate for females aged 15-17, for Columns 3-4 is the logged birth rate for females aged 18-19 and for Columns 5-6 is the logged birth rates for females aged 30-34. In Panels D, E, and F, the dependent variable for Columns 1-2, 3-4 and 5-6 is the white teen birth rate, black teen birth rate, and Hispanic teen birth rate, respectively. Robust standard errors are clustered at the state level and are shown in parentheses. All columns with control variables account for a policy-based measure of abortion access, state unemployment rates and median family income. The control variables for Columns 1-2 in the first three panels additionally include percent of females ages 15-17 who are black and percent of females ages 15-17 who are Hispanic, the control variables for Columns 3-4 in the first three panels control for the percent of females ages 18-19 who are black and the percent of females ages 18-19 who are Hispanic, and the control variables for Columns 5-6 in the first three panels control for the percent of females ages 30-34 who are black and the percent of females ages 30-34 who are Hispanic.

Table A1: Effect of Stress-Abstinence Policy on Logged Teen Birth Rates (Using All Untreated States as Controls)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	OLS	OLS	OLS	WLS	WLS	WLS	Poisson	Poisson	Poisson
Panel A. Average Treatment Effect									
Abstinence Mandate in Effect	-0.026 (0.023)	-0.016 (0.025)	-0.023 (0.027)	0.003 (0.020)	0.004 (0.021)	-0.000 (0.022)	-0.007 (0.019)	-0.004 (0.020)	-0.010 (0.021)
1 Year Prior to Enactment			-0.018 (0.015)			-0.008 (0.013)			-0.013 (0.013)
2 Years Prior to Enactment			-0.016 (0.018)			-0.015 (0.009)			-0.020** (0.009)
Panel B. Dynamic Treatment Effect									
Effect of Policy in Year of Enactment	-0.040** (0.016)	-0.030* (0.017)	-0.037* (0.020)	-0.024 (0.015)	-0.019 (0.016)	-0.023 (0.016)	-0.031** (0.014)	-0.027* (0.015)	-0.033** (0.015)
1 Years After Enactment	-0.015 (0.019)	0.005 (0.018)	-0.002 (0.020)	0.006 (0.019)	0.016 (0.018)	0.012 (0.018)	-0.002 (0.018)	0.008 (0.017)	0.002 (0.016)
2 Years After Enactment	-0.037 (0.029)	-0.023 (0.029)	-0.030 (0.030)	-0.005 (0.030)	-0.000 (0.030)	-0.004 (0.030)	-0.016 (0.030)	-0.010 (0.029)	-0.016 (0.029)
3 Years After Enactment	-0.043 (0.029)	-0.031 (0.030)	-0.038 (0.031)	-0.014 (0.026)	-0.013 (0.027)	-0.017 (0.027)	-0.024 (0.025)	-0.021 (0.025)	-0.027 (0.025)
4+ Years After Enactment	-0.010 (0.028)	-0.009 (0.037)	-0.016 (0.038)	0.028 (0.025)	0.021 (0.026)	0.017 (0.028)	0.020 (0.026)	0.018 (0.028)	0.012 (0.030)
1 Year Prior to Enactment			-0.018 (0.016)			-0.008 (0.013)			-0.013 (0.013)
2 Years Prior to Enactment			-0.016 (0.019)			-0.015 (0.009)			-0.020** (0.010)
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Estimates are based on annual data for 46 states from 2000-2011. Each column by panel represents coefficients from a separate regression. Robust standard errors are clustered at the state level and are shown in parentheses. The control variables include percent of females ages 15-19 who are black, percent of females ages 15-19 who are Hispanic, a policy-based measure of abortion access, state unemployment rates and median family income. Four states which dropped stress-abstinence policies during the sample period are excluded this analysis. These states include California, New Jersey, Maryland and West Virginia.

Table A2: Effect of Stress-Abstinence Policy on Logged Teen STD Rates (Using All Untreated States as Controls)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	OLS	OLS	OLS	WLS	WLS	WLS	Poisson	Poisson	Poisson
Panel A. Average Effects									
Abstinence Mandate in Effect	-0.001 (0.043)	0.020 (0.044)	0.025 (0.050)	0.011 (0.048)	0.020 (0.048)	0.038 (0.054)	0.020 (0.047)	0.038 (0.041)	0.061 (0.049)
1 Year Prior to Enactment			0.013 (0.047)			0.078* (0.046)			0.101** (0.044)
2 Years Prior to Enactment			0.010 (0.022)			0.018 (0.021)			0.014 (0.019)
Panel B. Dynamic Effects									
Effect of Policy in Year of Enactment	0.028 (0.029)	0.038 (0.030)	0.043 (0.036)	0.040 (0.030)	0.037 (0.030)	0.056 (0.037)	0.048* (0.027)	0.043* (0.025)	0.067** (0.034)
1 Years After Enactment	0.011 (0.038)	0.023 (0.037)	0.028 (0.040)	0.001 (0.033)	-0.003 (0.031)	0.015 (0.034)	-0.000 (0.029)	-0.003 (0.026)	0.020 (0.030)
2 Years After Enactment	0.001 (0.040)	0.021 (0.035)	0.026 (0.040)	-0.004 (0.036)	0.008 (0.031)	0.026 (0.036)	-0.009 (0.033)	0.008 (0.026)	0.031 (0.031)
3 Years After Enactment	-0.009 (0.059)	0.018 (0.062)	0.023 (0.068)	0.010 (0.076)	0.030 (0.078)	0.047 (0.084)	0.027 (0.077)	0.058 (0.075)	0.079 (0.082)
4+ Years After Enactment	-0.017 (0.057)	0.007 (0.067)	0.012 (0.073)	0.008 (0.075)	0.025 (0.079)	0.043 (0.085)	0.025 (0.067)	0.062 (0.067)	0.085 (0.074)
1 Year Prior to Enactment			0.013 (0.048)			0.078* (0.045)			0.101** (0.044)
2 Years Prior to Enactment			0.010 (0.022)			0.018 (0.021)			0.014 (0.020)
N	600	600	600	600	600	600	600	600	600
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Estimates are based on annual data for 46 states from 2000-2011. Each column by panel represents coefficients from a separate regression. Robust standard errors are clustered at the state level and are shown in parentheses. The control variables include percent of females ages 15-19 who are black, percent of females ages 15-19 who are Hispanic, a policy-based measure of abortion access, state unemployment rates and median family income. Four states which dropped stress-abstinence policies during the sample period are excluded this analysis. These states include California, New Jersey, Maryland and West Virginia.

Table A3: Effect of Stress-Abstinence Policy on Logged Teen Abortion Rates (Using All Untreated States as Controls)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	OLS	OLS	OLS	WLS	WLS	WLS	Poisson	Poisson	Poisson
Panel A. Average Effects									
Abstinence Mandate in Effect	-0.032 (0.041)	-0.034 (0.031)	-0.026 (0.044)	-0.022 (0.039)	-0.022 (0.035)	-0.021 (0.041)	-0.004 (0.024)	-0.003 (0.026)	0.000 (0.028)
1 Year Prior to Enactment			0.010 (0.028)			0.001 (0.020)			0.008 (0.015)
2 Years Prior to Enactment			-0.001 (0.035)			0.003 (0.034)			0.008 (0.029)
Panel B. Dynamic Effects									
Effect of Policy in Year of Enactment	-0.036 (0.026)	-0.039 (0.028)	-0.038 (0.040)	-0.016 (0.014)	-0.013 (0.018)	-0.012 (0.024)	-0.010 (0.012)	-0.004 (0.014)	-0.000 (0.018)
1 Years After Enactment	-0.064 (0.059)	-0.061 (0.055)	-0.061 (0.062)	-0.043 (0.059)	-0.036 (0.063)	-0.036 (0.068)	-0.010 (0.040)	-0.001 (0.044)	0.003 (0.046)
2 Years After Enactment	-0.048 (0.048)	-0.036 (0.033)	-0.035 (0.041)	-0.056 (0.045)	-0.045 (0.039)	-0.044 (0.043)	-0.032 (0.032)	-0.023 (0.033)	-0.020 (0.033)
3 Years After Enactment	-0.005 (0.052)	-0.009 (0.036)	-0.009 (0.048)	0.003 (0.053)	-0.000 (0.043)	0.000 (0.051)	0.018 (0.037)	0.012 (0.031)	0.015 (0.037)
4+ Years After Enactment	0.015 (0.043)	0.008 (0.039)	0.008 (0.043)	0.031 (0.028)	0.009 (0.039)	0.010 (0.039)	0.046** (0.019)	0.014 (0.031)	0.017 (0.030)
1 Year Prior to Enactment			0.004 (0.031)			0.001 (0.020)			0.008 (0.015)
2 Years Prior to Enactment			-0.002 (0.036)			0.003 (0.034)			0.009 (0.029)
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Estimates are based on annual data for 33 states from 2000-2009. Each column by panel represents coefficients from a separate regression. Robust standard errors are clustered at the state level and are shown in parentheses. The control variables include percent of females ages 15-19 who are black, percent of females ages 15-19 who are Hispanic, a policy-based measure of abortion access, state unemployment rates and median family income. Four states which dropped stress-abstinence policies during the sample period are excluded this analysis. These states include California, New Jersey, Maryland and West Virginia. Additionally, 13 states were removed from the analysis due to missing or inconsistent data. The states that were dropped for these regressions include Arizona, Colorado, Delaware, Florida, Illinois, Kentucky, Louisiana, Nevada, New Hampshire, New York, Rhode Island, Vermont and Wyoming.

Table A4: Effect of Stress-Abstinence Policy on Teen Birth Rates

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	OLS	WLS	WLS	WLS
Panel A. Average Treatment Effect						
Abstinence Mandate in Effect	0.086	0.099	-0.007	0.879	0.739	0.884
	(1.138)	(1.149)	(1.422)	(0.927)	(1.082)	(1.254)
1 Year Prior to Enactment			-0.043			0.690
			(0.991)			(0.832)
2 Years Prior to Enactment			-0.447			0.073
			(0.569)			(0.477)
Panel B. Dynamic Treatment Effect						
Effect of Policy in Year of Enactment	-0.951	-0.908	-1.055	-0.475	-0.469	-0.324
	(0.680)	(0.834)	(1.168)	(0.570)	(0.677)	(0.869)
1 Years After Enactment	-0.018	0.442	0.299	0.520	0.655	0.786
	(0.857)	(0.760)	(1.002)	(0.779)	(0.725)	(0.847)
2 Years After Enactment	-0.644	-0.589	-0.748	0.284	0.338	0.476
	(1.325)	(1.299)	(1.578)	(1.287)	(1.290)	(1.417)
3 Years After Enactment	-0.606	-0.631	-0.773	0.209	0.066	0.187
	(1.346)	(1.398)	(1.642)	(1.204)	(1.381)	(1.541)
4+ Years After Enactment	1.449	1.361	1.224	2.352*	2.237	2.364
	(1.336)	(1.595)	(1.858)	(1.190)	(1.641)	(1.861)
1 Year Prior to Enactment			-0.150			0.644
			(1.017)			(0.856)
2 Years Prior to Enactment			-0.516			0.054
			(0.613)			(0.510)
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	Yes	Yes	Yes	Yes

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Estimates are based on annual data for 26 states from 2000-2011. Each column by panel represents coefficients from a separate regression. Robust standard errors are clustered at the state level and are shown in parentheses. The control variables include percent of females ages 15-19 who are black, percent of females ages 15-19 who are Hispanic, a policy-based measure of abortion access, state unemployment rates and median family income.

Table A5: Effect of Stress-Abstinence Policy on Teen STD Rates

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	OLS	WLS	WLS	WLS
Panel A. Average Treatment Effect						
Abstinence Mandate in Effect	0.383	1.019	1.519	0.480	0.542	0.860
	(1.188)	(0.840)	(0.932)	(1.630)	(0.812)	(0.928)
1 Year Prior to Enactment			1.373			1.460
			(0.904)			(1.103)
2 Years Prior to Enactment			0.911			0.217
			(0.585)			(0.638)
Panel B. Dynamic Treatment Effect						
Effect of Policy in Year of Enactment	0.866	1.206**	1.738**	0.859	0.696	1.039
	(0.810)	(0.563)	(0.657)	(0.829)	(0.600)	(0.737)
1 Years After Enactment	0.486	0.918	1.421*	-0.175	-0.236	0.074
	(0.849)	(0.761)	(0.764)	(0.750)	(0.708)	(0.618)
2 Years After Enactment	0.293	0.880	1.429*	-0.316	-0.297	0.029
	(0.961)	(0.602)	(0.744)	(1.080)	(0.699)	(0.779)
3 Years After Enactment	0.448	1.421	1.903	0.750	1.232	1.522
	(1.725)	(1.482)	(1.588)	(2.504)	(1.908)	(2.023)
4+ Years After Enactment	0.071	0.831	1.297	0.847	1.093	1.395
	(1.804)	(1.575)	(1.605)	(2.604)	(1.472)	(1.562)
1 Year Prior to Enactment			1.381			1.437
			(0.865)			(1.090)
2 Years Prior to Enactment			0.914			0.217
			(0.617)			(0.644)
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	Yes	Yes	Yes	Yes

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Estimates are based on annual data for 26 states from 2000-2011. Each column by panel represents coefficients from a separate regression. Robust standard errors are clustered at the state level and are shown in parentheses. The control variables include percent of females ages 15-19 who are black, percent of females ages 15-19 who are Hispanic, a policy-based measure of abortion access, state unemployment rates and median family income.

Table A6: Effect of Stress-Abstinence Policy on Teen Abortion Rates

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	OLS	WLS	WLS	WLS
Panel A. Average Treatment Effect						
Abstinence Mandate in Effect	-0.123	-0.168	-0.047	-0.176	-0.068	0.011
	(0.397)	(0.298)	(0.415)	(0.469)	(0.312)	(0.381)
1 Year Prior to Enactment			0.273			0.079
			(0.531)			(0.454)
2 Years Prior to Enactment			0.208			0.301
			(0.565)			(0.546)
Panel B. Dynamic Treatment Effect						
Effect of Policy in Year of Enactment	-0.356	-0.175	-0.047	-0.100	0.103	0.181
	(0.344)	(0.262)	(0.417)	(0.381)	(0.229)	(0.358)
1 Years After Enactment	-0.428	-0.327	-0.200	-0.186	0.032	0.112
	(0.427)	(0.606)	(0.609)	(0.585)	(0.657)	(0.662)
2 Years After Enactment	-0.245	0.069	0.207	-0.668	-0.318	-0.237
	(0.468)	(0.563)	(0.646)	(0.454)	(0.449)	(0.466)
3 Years After Enactment	0.261	-0.078	0.039	-0.043	0.025	0.106
	(0.725)	(0.509)	(0.638)	(0.746)	(0.492)	(0.572)
4+ Years After Enactment	0.649	-0.998	-0.883	0.600	-0.642	-0.557
	(0.475)	(0.902)	(0.868)	(0.512)	(0.804)	(0.806)
1 Year Prior to Enactment			0.305			0.091
			(0.520)			(0.452)
2 Years Prior to Enactment			0.201			0.294
			(0.542)			(0.545)
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	Yes	Yes	Yes	Yes

Notes: *p<0.1, **p<0.05, ***p<0.01. Estimates are based on annual data for 26 states from 2000-2011. Each column by panel represents coefficients from a separate regression. Robust standard errors are clustered at the state level and are shown in parentheses. The control variables include percent of females ages 15-19 who are black, percent of females ages 15-19 who are Hispanic, a policy-based measure of abortion access, state unemployment rates and median family income. Eleven states were removed from the analysis due to missing or inconsistent data. The states that were dropped for these regressions include California, Colorado, Delaware, Florida, Illinois, Kentucky, Maryland, New York, Rhode Island, Vermont and West Virginia.

Table A7: Effect of Stress-Abstinence Policy on Teen Abortion Rates without Dropping States with Missing or Inconsistent Abortion Data

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	OLS	OLS	OLS	WLS	WLS	WLS	Poisson	Poisson	Poisson
Panel A. Average Treatment Effect									
Abstinence Mandate in Effect	0.034 (0.064)	0.035 (0.062)	0.076 (0.086)	0.045 (0.060)	0.034 (0.047)	0.059 (0.067)	0.066 (0.044)	0.052 (0.036)	0.065 (0.044)
1 Year Prior to Enactment			0.146* (0.078)			0.066 (0.079)			0.043 (0.065)
2 Years Prior to Enactment			0.123 (0.090)			0.050 (0.055)			0.023 (0.046)
Panel B. Dynamic Treatment Effect									
Effect of Policy in Year of Enactment	0.066 (0.070)	0.069 (0.057)	0.128 (0.090)	0.112 (0.099)	0.097 (0.091)	0.124 (0.098)	0.136 (0.107)	0.120 (0.105)	0.137 (0.101)
1 Years After Enactment	0.033 (0.089)	0.062 (0.121)	0.116 (0.151)	0.082 (0.113)	0.105 (0.125)	0.128 (0.140)	0.115 (0.094)	0.135 (0.092)	0.150 (0.100)
2 Years After Enactment	0.014 (0.078)	0.014 (0.059)	0.077 (0.102)	-0.019 (0.068)	-0.035 (0.046)	-0.009 (0.066)	-0.006 (0.044)	-0.020 (0.042)	-0.005 (0.050)
3 Years After Enactment	0.006 (0.053)	-0.011 (0.039)	0.044 (0.066)	-0.017 (0.054)	-0.039 (0.047)	-0.017 (0.058)	0.003 (0.038)	-0.036 (0.039)	-0.023 (0.047)
4+ Years After Enactment	0.049 (0.044)	-0.051 (0.060)	0.006 (0.075)	0.029 (0.042)	-0.079 (0.078)	-0.058 (0.086)	0.051 (0.036)	-0.070 (0.069)	-0.060 (0.072)
1 Year Prior to Enactment			0.125 (0.089)			0.071 (0.078)			0.050 (0.061)
2 Years Prior to Enactment			0.119 (0.091)			0.048 (0.053)			0.023 (0.043)
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Estimates are based on annual data for 15 states from 2000-2009. Each column by panel represents coefficients from a separate regression. Robust standard errors are clustered at the state level and are shown in parentheses. The control variables include percent of females ages 15-19 who are black, percent of females ages 15-19 who are Hispanic, a policy-based measure of abortion access, state unemployment rates and median family income.

Table A8: Effect of Stress-Abstinence Policy on Logged Teen Birth Rate (Triple Difference)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	OLS	OLS	OLS	WLS	WLS	WLS	Poisson	Poisson	Poisson
Panel A. Average Effects									
Abstinence Mandate in Effect	-0.006	-0.006	-0.002	0.021	0.021	0.026	0.010	0.012	0.015
	(0.021)	(0.021)	(0.026)	(0.018)	(0.018)	(0.023)	(0.017)	(0.017)	(0.021)
1 Year Prior to Enactment			0.002			0.015			0.011
			(0.017)			(0.019)			(0.017)
2 Years Prior to Enactment			0.014			0.008			0.005
			(0.017)			(0.011)			(0.010)
Panel B. Dynamic Effects									
Effect of Policy in Year of Enactment	-0.014	-0.014	-0.011	0.005	0.005	0.009	-0.002	-0.002	0.002
	(0.017)	(0.017)	(0.019)	(0.011)	(0.011)	(0.013)	(0.010)	(0.010)	(0.013)
1 Years After Enactment	0.004	0.004	0.007	0.030*	0.030*	0.035**	0.021	0.022*	0.025*
	(0.018)	(0.018)	(0.020)	(0.015)	(0.015)	(0.016)	(0.013)	(0.013)	(0.014)
2 Years After Enactment	-0.018	-0.018	-0.014	0.020	0.020	0.024	0.007	0.008	0.011
	(0.026)	(0.026)	(0.027)	(0.023)	(0.023)	(0.024)	(0.021)	(0.021)	(0.022)
3 Years After Enactment	-0.026	-0.026	-0.022	0.005	0.005	0.010	-0.006	-0.005	-0.001
	(0.023)	(0.023)	(0.026)	(0.019)	(0.020)	(0.023)	(0.017)	(0.017)	(0.020)
4+ Years After Enactment	0.011	0.011	0.015	0.033	0.033	0.038	0.025	0.026	0.030
	(0.032)	(0.032)	(0.040)	(0.037)	(0.037)	(0.043)	(0.034)	(0.035)	(0.039)
1 Year Prior to Enactment			0.003			0.015			0.011
			(0.017)			(0.019)			(0.017)
2 Years Prior to Enactment			0.015			0.009			0.005
			(0.020)			(0.012)			(0.011)
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Estimates are based on annual data for 26 states from 2000-2011. Each column by panel represents coefficients from a separate triple-difference regression using the female 30-34 year old population as a within-state control group, and the reported coefficients are for the teen group. Robust standard errors are clustered at the state level and are shown in parentheses. The control variables include percent of females ages 15-19 who are black, percent of females ages 15-19 who are Hispanic, a policy-based measure of abortion access, state unemployment rates and median family income.